

ANÁLISIS DE LAS CREENCIAS EPISTEMOLÓGICAS DE ESTUDIANTES COLOMBIANOS SEGÚN VARIABLES SOCIODEMOGRÁFICAS Y EDUCATIVAS

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Resumen

El objetivo principal del presente estudio es analizar y caracterizar la influencia de las variables educativas y sociodemográficas sobre el grado de desarrollo de las creencias epistemológicas (CE) en estudiantes universitarios y de último año de bachillerato. Para conseguir este objetivo se administró un instrumento llamado EQEBI, que mide las CE a una muestra de 1.387 alumnos en Bogotá (Colombia). La metodología utilizada fue cuantitativa y no experimental. Para comparar las CE de acuerdo con los grupos conformados según las variables analizadas, se utilizaron las pruebas estadísticas no paramétricas de Mann-Whitney y Kruskal-Wallis. Los resultados indican diferencias significativas en las CE por sexo, nivel socioeconómico y nivel educativo de los estudiantes y de sus padres. Sin embargo, no se encontraron diferencias según el entorno de procedencia (rural o urbano), ni por la repetición de curso. Este estudio tiene implicaciones para el diseño de programas educativos específicos, según las características de los alumnos, que favorezcan el desarrollo de las CE.

Palabras clave: creencias epistemológicas, EQEBI, educación, variables educativas y sociodemográficas.

EPISTEMOLOGICAL BELIEFS OF COLOMBIAN STUDENTS ACCORDING TO EDUCATIONAL AND SOCIO-DEMOGRAPHIC VARIABLES

Abstract

The main goal of the present study is to analyze and characterize the influence of educational and socio-demographical variables on the Epistemological Beliefs (EB) of senior year and university students. With this aim, an instrument that measures EB, called EQEBI, was applied to a sample of 1387 students in Bogota-Colombia. The methodology used was quantitative, non experimental, and the nonparametric statistics tests of Mann-Whitney and Kruskal-Wallis were used to compare the EB according to the groups formed by the variables analyzed. Results indicate significant differences in EB by sex, socioeconomic status and educational level of students and his parents, but no differences according to the environmental background (rural or urban) and grade repetition. This study has implications for the design of specific educational programs, according to the characteristics of students, to encourage the development of EB.

Key words: epistemological beliefs, EQEBI test, education, educational and socio-demographic variables.

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ANÁLISE DAS CRENÇAS EPISTEMOLÓGICAS DE ESTUDANTES COLOMBIANOS SEGUNDO VARIÁVEIS SOCIODEMOGRÁFICAS E EDUCATIVAS

Resumo

O objetivo principal do presente estudo é analisar e caracterizar a influência de variáveis educativas e sociodemográficas sobre o grau de desenvolvimento das crenças epistemológicas (CE) em estudantes universitários e do último ano do ensino médio. Para atingir esse objetivo, administrou-se um instrumento chamado EQEBI, que mede as CE a uma amostra de 1.387 alunos em Bogotá (Colômbia). A metodologia utilizada foi quantitativa e não experimental. Para comparar as CE de acordo com os grupos formados segundo as variáveis analisadas, utilizaram-se as provas estatísticas não paramétricas de Mann-Whitney e Kruskal-Wallis. Os resultados indicam diferenças significativas nas CE por sexo, nível socioeconômico e nível educativo dos estudantes e de seus pais. Contudo, não se encontraram diferenças segundo o ambiente de procedência (rural ou urbano) nem pela repetição de curso. Este estudo tem implicações para o desenho de programas educativos específicos, conforme as características dos alunos, que favoreçam o desenvolvimento das CE.

Palavras-chave: crenças epistemológicas, EQEBI, educação, variáveis educativas e sociodemográficas.

Epistemology studies the nature of knowledge, how it is acquired and its scope (Aulls y Lemay, 2013; Escalante, 2010). An important branch of epistemology studies the concepts students have about learning and knowledge. Some of the research on this topic are based on the theory that the students' source of actions and strategies to achieve learning goals depends on a group of preconceived ideas or concepts about the acquisition of knowledge called Epistemological Beliefs-EB (Angeli & Valanides, 2012; Martínez, Montero & Pedrosa, 2010; Schommer, Beuchat & Hernández, 2012; Terzi, Çetin & Eser, 2012). For that reason, the analysis of EB and the factors that may influence their development are essential to educators and psychologists interested in the improvement of students' learning actions and strategies in different educational levels.

Commonly, EB have been analyzed following a phenomenological tradition (Marton, 1981) centered on the analysis of verbal protocols with short answers and semi-structured interviews, with subsequent categorization. However, other methods have also been used to investigate EB, such as questionnaires and quasi-experimental tasks. In fact, the latter is the methodological perspective used in the present work. Early research from this point of view are attributed to Perry in the 70s (Acosta, 2009; Escalante, 2010; Rodríguez, 2005) who noted that epistemological development evolves from absolutist and dualist visions towards the idea of knowledge based on observation and reasoning (Brownlee, 2003; Herron, 2010; King and Magun, 2009). Perry's ideas exerted a great impact on other researchers because they began to consider the evolving nature of EB (Briell, Elen and Clarebout, 2013).

Following the evolving perspective, Schommer (1990) proposed that EB have different degrees of sophistication. The author presents a set of five dimensions that compose EB:

1. Certain Knowledge (CK): ranges from the pole of considering knowledge as certain, absolute and immutable, to the belief that knowledge is tentative and changing.

2. Simple Knowledge (SK): oscillates from the conception of knowledge as isolated and simple to the belief that knowledge is complex and integrated.

3. Omniscient Authority (OA): varies from the belief that the sources of knowledge are the experts to the belief that reason is the main source of knowledge.

4. Quick Learning (QL): oscillates from the conception that learning is quick and effortless to the belief that it is slow and gradual.

5. Innate Ability (IA): ranges from the belief that learning is genetically determined to the conception of learning as a process of environmental construction.

According to Schommer (1990), the five dimensions that compose EB are independent, so that the same person may have sophisticated beliefs in one dimension and simple conceptions in other (Terrazas & Frenay, 2009; Vizcaino, Otero & Mendoza, 2013). Although this is the EB classification more used for research and development of measurement instruments, other classification systems have also been proposed (Pozo & Scheuer, 1999; Säljö, 1979).

Within the researchers' interest for getting to know and promoting a better developing of EB, the study of variables or factors that may influence EB is highlighted. Those studies include analysis of two types of variables: socio-demographic variables such as age, gender, and socio-economic status, and educational variables such as maximum study level reached by students and their parents, type of school or learning strategies, among others. The results of some previous studies that use similar variables to the ones selected in this study are presented below.

1. Socio-demographic variables. Several studies have found evidence that personal characteristics such as gender or age influence the development of EB. In the case of gender, there are mixed results (Özkan & Tekkaya, 2011; Walter, 2008): some researchers did not find significant differences (Buehl, Alexander & Murphy, 2002; Chan & Elliott, 2002) but others pointed out differences in one or more EB dimensions. For example, it has been documented that women show sophisticated beliefs regarding quick learning, but less developed beliefs on simple knowledge (Cano, 2005; Hofer, 2000; Paulsen & Wells, 1998; Schommer, Calvert, Gariglietti & Bajaj, 1997; Schommer & Dannel, 1994; Walker, 2008). Other authors have found that men have less sophisticated beliefs on omniscient authority and certain knowledge (Bendixen, Schraw & Dunkle, 1998; Hofer, 2000).

Regarding age, there is consensus on the results. Several authors report an evolving change from less sophisticated beliefs to more developed conceptions, as age increases (Conley, Pintrich, Vekiri & Harrison, 2004; García & Sebastián, 2011; Paechter et al., 2013). Other authors have found that EB depend on the acquisition of experiences in learning contexts (Lahtinen & Pehkonen, 2013; Taha & El-Habbal, 2013). Moreover, Schommer (1990) concludes that EB are developed in a recursive process that lasts a lifetime.

On the other hand, there are very few studies focused on the analysis of other variables such as socio-economic status or environmental background. Regarding socio-economic status, Cano and Cardelle (2008) have found that students of low socioeconomic status have less developed beliefs than the average and consider that the source of knowledge is external. In a similar way, Ozkal, Tekkaya, Sungur, Cakiroglu and Cakiroglu (2011) observed that students of high socioeconomic status tended to see knowledge as tentative and self-oriented.

2. Educational variables. One of the pioneers in the study of the relationship between educational variables and the development of EB has been Säljö (1979) who established and verified the hypothesis of the existence of a significant relationship between EB and learning strategies. There is consensus in the research regarding that a high level of education of students and their parents is associated with more development of EB (Baldwin & Alsumait, 2013; Walker, 2008).

For example, Mason, Boldrin and Zurlo (2006) mark a turning point in the development of EB among elementary (5th grade) and high-school (8th grade) students. Önen (2011) also indicated that EB increase as the educational level gets higher. Marzocchi, Fouladchang and Shemshiri

(2007) concluded that students in the first year of university had simpler beliefs, for example, they considered that knowledge is acquired faster compared to fourth year students. Similarly, Jehng, Johnson and Anderson (1993) found that undergraduate students had less developed EB when compared with a group of graduate students.

Regarding the influence of the educational level of parents, Schommer (1990) found that a high educational level of both parents increases the likelihood that children acquire a more sophisticated epistemological system. However, this important variable has been little discussed in the scientific literature. In other research, Topçu and Yilmaz (2009) found differences in QL according to the mother's educational level; in particular, students with more educated mothers tend to perceive learning as a slow and gradual process.

On the other hand, some studies have focused on assessing whether there are differences in EB according to the area of study, finding that beliefs vary between different knowledge domains (Llinares, Garcia Casino & Martí, 2013). For example, it has been found that students of social sciences, humanities and arts have more sophisticated beliefs regarding certain knowledge, simple knowledge and omniscient authority as opposed to students of mathematics, engineering and business (Hofer, 2000; Jehng, Johnson & Anderson, 1993; Schommer & Orpah, 2013).

In an effort to deepen the results of the studies presented above, the overall objective of this paper is to analyze the influence of sociodemographic and educational variables on the level of development of EB in a large sample of Colombian students. To achieve the proposed goal the following variables have been selected, measured and analyzed: sex (men/women), type of school (private/public), grade repetition during high-school (yes/not), environmental background (rural/urban), study level (secondary/university), parents' study level (primary, secondary, university or postgraduate), socioeconomic level (from 1 to 6, where 1 is very low and 6 is very high) and study area (Psychology, Philosophy, Philology, Engineering and Economics). Based on the results of previous research, the hypotheses of this research are:

1. Regarding the influence of sociodemographic variables: a) there will be significant differences in EB according to personal characteristics such as sex or age (Bendixen, Schraw & Dunkle, 1998; Cano, 2005; Hofer, 2000; Paulsen & Wells, 1998; Schommer & Dannel, 1994), b) there will be no significant differences according to student's environmental background (Topçu & Yilmaz, 2009), and c) EB will be more developed in students of higher socioeconomic status (Conley et al., 2004; Ozkal et al., 2011).

2. Regarding the influence of educational variables: a) there will be significant differences between students of public and private schools (Ismail et al., 2013), b) students who repeat some course during high-school will have less developed EB (Hofer, 2000; Schommer et al., 1997; Paulsen & Wells, 1998), c) EB will be more developed in students with parents of higher educational level (Schommer, 1990; Topçu & Yilmaz, 2009), d) the EB of high-school students will be less developed than the EB of university students (Baldwin & Alsumait, 2013; Walker, 2008), and d) there will be significant differences in EB according to the area of study (Hofer, 2000; Schommer & Orpha, 2013).

METHOD

Participants

A total of 1387 students participated in this study, 890 were university students and 490 were high-school students. 54.7% of the students were men and 45.3% women. Regarding age, the mean was 18.2 years ($DT=2.6$) and the minimum and maximum ages were 14 and 40 years, respectively. The sample was by convenience, and therefore was not probabilistic. The students participated voluntarily and with informed consent. The use of data for research purposes and confidentiality of information was assured.

Instruments

To carry out this study a self-report instrument was applied, consisting of an introductory block in which information about sociodemographic and educational variables were collected, followed by a second block containing the EQEBI, an instrument in Spanish language, Likert type, that measures epistemological beliefs and was proposed by Ordoñez, Ponsoda, Abad and Romero (2009). The EQEBI consists of the following 4 dimensions: Certain Knowledge (4 items), Simple Knowledge (4 items), Quick Learning (11 items) and Innate Ability (8 items), with reliability coefficients (Cronbach's α) of .88, .70, .67 and .81 respectively (Ordoñez et al., 2009). Regarding the validity scores, the authors carried out two independent studies that confirm the four-dimensional structure in both cases. In addition, Ordoñez et al. (2009) analyzed the items of EQEBI with the graduated response model and reported adequate psychometric properties of the test.

Procedure

As a first step of this research, the analysis of the theoretical documentation supporting this project was conducted. Based on this analysis the variables to be used were selected and the instrument used to collect information was designed. The second step was the initial contact with the schools and universities which,

due to their relationship with the researchers, could collaborate with data collection. Upon confirmation of the participant institutions, the instrument was provided to students in the format of "paper and pencil" during class time, through the teachers of the schools and universities that participated in the study. One of the members of the research team was present at the time of the test application. Once data were collected, data analysis was carried out in several stages: a) code preparation, b) file structure, c) data recording, d) review and correction of erroneous data, e) assumption testing and d) data analysis, which in turn included variable descriptions and comparison of groups according to the previously selected variables.

Data analysis

This research is quantitative and non-experimental. A descriptive and comparative methodology was used (Ato, López & Benavente, 2013). The variables analyzed (sociodemographic, educational and EB) were measured with a self-report instrument whose characteristics are specified in the following section. Data analysis was carried out using SPSS 20. Due to failure to comply with the assumptions required for the proper use of parametric statistics, comparison between groups was made by using non-parametric tests: Mann-Whitney's U (two groups) and Kruskal-Wallis's H (more than two groups). The size of the effect was calculated by means of the r statistic, the more appropriate for this type of analysis.

RESULTS

The results of the study are presented as follows: first, a description of the socio-demographic and educational characteristics of the sample is presented. Second, testing of parametric statistics assumptions is exposed. Third, the results of the analysis of differences in students' EB by gender, type of school, repetition, environmental background, educational level, parental education, socioeconomic status and area of study are presented.

Sample characteristics

Regarding the sample characteristics, 62% of the students came from private schools and 37% from public schools. 20.2% repeated some school grade and 91.3% came from an urban environment. The distribution according to social status was as follows: 1 (4.6%), 2 (13.6%), 3 (36.3%), 4 (29.4%), 5 (11.3%) and 6 (4.8%). With regard to the educational level of fathers, the distribution was as follows: primary (13.9%), secondary (32.5%), university (32.7%) and postgraduate (20.9%); with respect to the educational level of mothers, the

distribution was: primary (13.4%), secondary (40.3%), university (31.9%) and postgraduate (14.4%).

Testing of parametric assumptions

Regarding assumptions for checking the correct use of parametric statistics, Tables 1 and 2 show that the

normality assumption is not met in any of the groups analyzed (except in philosophy and some scales of high school). Due to the failure to comply with this assumption it was decided to use nonparametric statistics for group comparison.

Table 1.

Shapiro-Wilk test for groups formed by gender, type of institution, repetition and education of father and mother

	Sex		Type		Repetition		Educational level of fathers				Educational level of mothers			
	V	M	Pub.	Priv.	Si	No	1	2	3	4	1	2	3	4
Total	.876*	.847*	.861*	.864*	.901*	.851*	.910*	.870*	.851*	.839*	.921*	.861*	.859*	.811*
QL	.887*	.855*	.875*	.900*	.935*	.855*	.926*	.890*	.927*	.855*	.910*	.890*	.876*	.813*
IA	.963*	.940*	.959*	.938*	.960*	.949*	.964*	.959*	.958*	.958*	.959*	.960*	.947*	.947*
CK	.946*	.929*	.914*	.937*	.942*	.962*	.958*	.945*	.968*	.954*	.952*	.947*	.965*	.915*
SK	.979*	.985*	.984*	.979*	.982*	.983*	.960*	.978*	.977*	.978*	.962*	.977*	.976*	.973*

Note: * $p < .01$

a: 1. Primary 2. Secondary 3. University 4. Postgraduate

Table 2.

Shapiro-Wilk test for groups formed by environmental background, social status and study area

	Environmental Background		Social Status						Study Area ^a					
	Rural	Urb.	1	2	3	4	5	6	1	2	3	4	5	6
Total	.866*	.875*	.939*	.905*	.853*	.858*	.914*	.681*	.847*	.853*	.939	.975*	.805*	.887*
QL	.939*	.847*	.873*	.920*	.890*	.876*	.859*	.734*	.853*	.842*	.956	.762*	.839*	.892*
IA	.948*	.937*	.966*	.970*	.969*	.967*	.972*	.909*	.942*	.948*	.921	.915	.854*	.955*
CK	.972*	.878*	.933*	.935*	.939*	.955*	.977*	.922*	.933*	.952*	.970	.781*	.929	.931*
SK	.982*	.973**	.937*	.982*	.983*	.969*	.964*	.899*	.968*	.966*	.898	.943	.938	.983*

Note: * $p < .01$

a: 1. Engineering 2. Psychology 3. Philosophy 4. Philology 5. Economics 6. High School

Differences in EB according to sex

Statistical hypothesis: the null hypothesis is that the central tendency of the EB scores for both sexes is the same [$H_0: E(\text{Female}) = E(\text{Male})$], the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(\text{Female}) \neq E(\text{Male})$].

The Mann-Whitney test indicates that the null hypothesis can be rejected in the case of CK ($U = 194810$, $Z = 2.927$, $p = .003$). Some more elaborate beliefs are seen in males ($Mdn = 9$) than in females ($Mdn = 10$); however, the effect size is low ($r = .081$). For the remaining scales and the total score the null hypothesis cannot be rejected: Total ($U = 169002.5$, $Z = 1.108$, $p = .268$), SK ($U = 209\ 854$, $Z = -.660$, $p = .509$), IA ($U = 203869$, $Z = -.133$, $p = .894$) and QL ($U = 191208.5$, $Z = 1.506$, $p = .132$).

Differences in EB according to school type

Statistical hypothesis: the null hypothesis is that the central tendency of EB scores of students from private schools equals the tendency of students from public schools [$H_0: E(\text{Pr}) = E(\text{Pu})$]; the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(\text{Pr}) \neq E(\text{Pu})$]. The Mann-Whitney test showed a statistically significant difference between students coming from public and private schools in the total test scores ($U = 214322$, $Z = 3.093$, $p = .002$) and in the scales QL ($U = 140693$, $Z = 2.798$, $p = .005$), SK ($U = 144726$, $Z = 4.194$, $p = .003$) and CK ($U = 125649.5$, $Z = 7.096$, $p < .000$). These differences indicate more sophisticated total beliefs in students from private schools ($Mdn = 57$) than in students from public schools ($Mdn = 58$). Regarding the QL scale there is more development in students from private schools ($Mdn = 21$) compared with students from public institutions ($Mdn = 22$). The same occurs for SK scales (private = 9 vs public = 10) and CK (private = 10 vs public = 11). The size effect was low-moderate ($r = .077$, $r = .082$, $r = .121$ and $r = .206$, respectively). There are no significant differences in the scale IA ($U = 151750.5$, $Z = 1.630$, $p = .103$).

Differences in EB by grade repetition

Statistical hypothesis: the null hypothesis is that the central tendency of EB ss is the same for students who have repeated and for those who have not repeated school grades [$H_0: E(\text{rep}) = E(\text{no rep})$]; the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(\text{rep}) \neq E(\text{no rep})$]. According to the Mann-Whitney test it was not possible to reject the null hypothesis, nor for the total test ($U = 87855$, $Z = 1.078$, $p = .281$), nor for any of the subscales: QL ($U = 105402.5$, $Z = -.815$, $p = .415$), SK ($U = 113411.5$, $Z = -.495$, $p = .621$), IA ($U = 106294.5$, $Z = -.114$, $p = .910$) and CK ($U = 106647$, $Z = 1.424$, $p = .154$).

Differences in EB according to environmental background

Statistical hypotheses: the null hypothesis is that the central tendency of EB sc for students from rural and urban environments is the same [$H_0: E(R) = E(U)$]; the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(R) \neq E(U)$].

According to the Mann-Whitney test, it was not possible to reject the null hypothesis, nor for the total test ($U = 50673.5$, $Z = -.520$, $p = .603$), nor for any of the subscales: QL ($U = 56913$, $Z = 1.477$, $p = .140$), SK ($U = 66268.5$, $Z = -.106$, $p = .916$), IA ($U = 59957$, $Z = -.816$, $p = .414$) and CK ($U = 61696.5$, $Z = 1.419$, $p = .156$).

Differences in EB by educational level

Statistical hypothesis: the null hypothesis is that the central tendency of EB scores of university and high-school senior year students is the same [$H_0: E(B) = E(U)$]; the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(B) \neq E(U)$]. According to the Mann-Whitney test there is evidence to reject the null hypothesis in the total test scores ($U = 137\ 217$, $Z = 3.485$, $p < .000$), and in the scales QL ($U = 169\ 372$, $Z = 2.945$, $p = .003$), SK ($U = 181\ 985$, $Z = 3.302$, $p = .001$) and CK ($U = 129491.5$, $Z = 10.973$, $p < .000$). The differences in the central tendency indicate that college students have more elaborate beliefs than students of high-school, with medians of 56 and 58, respectively, in the total score; medians of 21 and 22 respectively, on the QL scale and medians of 9 and 10, respectively, in the CK and SK scales. The size effect was low-moderate ($r = .100$; $r = .083$, $r = .091$ and $r = .301$). It was not possible to reject the null hypothesis of the scale IA ($U = 191422$, $Z = -.343$, $p = .732$).

Differences in EB according to parents' educational level

Statistical hypothesis: the null hypothesis is that the central tendency of the EB scores is the same in students with parents of different educational levels [$H_0: E(\text{primary}) = E(\text{secondary}) = E(\text{university}) = E(\text{postgraduate})$], the alternative hypothesis is that the central tendency of the scores is different [$H_1: E(\text{primary}) \neq E(\text{secondary}) \neq E(\text{university}) \neq E(\text{postgraduate})$].

The Kruskal-Wallis test showed statistically significant differences according to the father's education in total test scores ($H = 13.49$, $df = 3$, $p = .004$) and in the SK scales ($H = 24.68$, $df = 3$, $p < .000$) and CK scales ($H = 92.57$, $df = 3$, $p < .000$). There are no significant differences in other scales: IA ($H = 3.752$, $df = 3$, $p = .290$) and QL ($H = 3.642$, $df = 3$, $p = .303$). To find out what specific groups exhibit differences, a post-hoc analysis using the Mann-Whitney test with Bonferroni correction was made. This test indicates that the total score differences occur between the groups of primary-university ($U = 26656$, $Z = 3.273$, p

= .001, $r = .290$) and primary-postgraduate ($U = 173125$, $Z = 2.954$, $p = .003$, $r = .338$). On the SK scale there are differences between the groups of primary-secondary ($U = 29274.5$, $Z = 4.505$, $p < .000$, $r = .194$), primary-university ($U = 33536.5$, $Z = 2.774$, $p = .006$, $r = .112$) and primary-postgraduate ($U = 18823$, $Z = 4.084$, $p < .000$, $r = .193$). Finally, in the CK scale there are differences between the groups of secondary-university ($U = 65009$, $Z = 6.593$, $p < .000$, $r = .290$), secondary-postgraduate ($U = 38730$, $Z = -6.370$, $p < .000$, $r = .338$), primary-university ($U = 23716.5$, $Z = 7.078$, $p < .000$, $r = .227$) and primary-postgraduate ($U = 13954$, $Z = 7.062$, $p < .000$, $r = .244$). The differences indicate more elaborate beliefs in students with fathers of higher levels of education, as can be seen in Table 3.

The H test also showed a significant difference according to mother's educational level in total test scores ($H = 11.937$, $df = 3$, $p = .008$), and in the scales SK ($H = 18.367$, $df = 3$, $p < .000$) and CK ($H = 78.089$, $df = 3$, $p < .000$). In the other scales there is no difference: IA ($H = 2.438$, $df = 3$, $p = .487$) and QL ($H = 2.012$, $df = 3$, $p = .570$).

The post-hoc analysis indicates that these differences occur in the total score between the groups of primary-university ($U = 26456.5$, $Z = 2.870$, $p = .004$, $r = .123$) and primary-postgraduate ($U = 11826.5$, $Z = 2.727$, $p = .006$, $r = .148$). For the SK scale, differences occur between groups of secondary-university ($U = 94630$, $Z = 3.355$, $p = .001$, $r = .109$), secondary-postgraduate ($U = 42658$, $Z = 3.032$, $p = .002$, $r = .113$), primary-university ($U = 32032$, $Z = 2.623$, $p = .009$, $r = .108$) and primary-postgraduate ($U = 14438.5$, $Z = 2.595$, $p = .009$, $r = .135$). For the CK scale, the differences occur between groups of primary-university ($U = 23990.5$, $Z = 6.054$, $p < .000$, $r = .254$), primary-postgraduate ($U = 10395.5$, $Z = 5.324$, $p < .000$, $r = .284$), secondary-university ($U = 72938.0$, $Z = 6.538$, $p < .000$, $r = .219$) and secondary-postgraduate ($U = 31731$, $Z = 5.216$, $p < .000$, $r = .200$). The differences indicate developed EB in students with mothers of higher levels of education, as can be seen in the Table 3.

Table 3.

Median scores of EQEBI, SK and CK scales according to educational level of father and mother

EQEBI	Total				SK				CK			
	1	2	3	4	1	2	3	4	1	2	3	4
Father	59	58	56	56	10	9	9	9	12	11	9	9
Mother	59	58	56	56	9	9	9	8	11	11	9	9

Differences in EB according to social stratum

Statistical hypothesis: the null hypothesis is that the central tendency of EB scores is the same in the six social strata [H_0 : $E(1) = E(2) = E(3) = E(4) = E(5) = E(6)$]; the alternative hypothesis is that the central tendency is different between some of the strata [H_1 : $E(1) \neq E(2) \neq E(3) \neq E(4) \neq E(5) \neq E(6)$].

The Kruskal-Wallis test showed a statistically significant difference according to social stratum in the total test scores ($H = 17.335$, $df = 5$, $p = .004$) and in the SK scales ($H = 23.909$, $df = 5$, $p < .000$), IA ($H = 20.789$, $df = 5$, $p = .001$) and CK scales ($H = 78.280$, $df = 5$, $p < .000$). In the scale QL no significant differences were found ($H = 2.950$, $df = 5$, $p = .708$).

The post-hoc analysis indicates that these differences occur in the total score between strata 1 and 3 ($U = 8331$, $Z = 3.342$, $p = .001$, $r = .133$), 1 and 4 ($U = 6653.5$, $Z = 3.458$,

$p = .001$, $r = .174$), 1 and 5 ($U = 2529.5$, $Z = 3.015$, $p = .003$, $r = .223$) and 1 and 6 ($U = 1026.5$, $Z = 2.905$, $p = .004$, $r = .277$). Students of stratum 1 exhibit less sophisticated beliefs in all cases. Post-hoc analysis also indicate differences in the SK scale between the strata 1 and 3 ($U = 10383$, $Z = 3.058$, $p = .002$, $r = .134$), 1 and 4 ($U = 7288.5$, $Z = 3.937$, $p < .000$, $r = .193$), 1 and 5 ($U = 2992.5$, $Z = 3.219$, $p = .001$, $r = .228$), 1 and 6 ($U = 1069$, $Z = 3.127$, $p = .002$, $r = .293$), 2 and 4 ($U = 25736$, $Z = 2.970$, $p = .003$, $r = .129$). Again, students from lower strata (1 and 2) exhibit less developed beliefs.

There are differences in the scale IA between strata 3 and 4 ($U = 59474.5$, $Z = 3.047$, $p = .002$, $r = .112$) and 3 and 6 ($U = 9336.5$, $Z = 3.469$, $p = .001$, $r = .158$). The meaning of this difference indicates that students of stratum 3 have more sophisticated EB than those of stratum 4 and 6. In the CK scale there are differences between the strata 1 and 3 ($U = 105109$, $Z = 3.344$, $p = .001$, $r = .145$), 1 and 4 ($U =$

6343, $Z = 5.442$, $p < .000$, $r = .263$), 1 and 5 ($U = 2426.5$, $Z = 4.811$, $p < .000$, $r = .340$), 1 and 6 ($U = 2919$, $Z = 4.519$, $p < .000$, $r = .414$); 2 and 3 ($U = 33089.5$, $Z = 3.352$, $p = 0.001$, $r = 0.133$), 2 and 4 ($U = 20615.5$, $Z = 6.447$, $p < .000$, $r = .278$), 2 and 5 ($U = 7751.5$, $Z = 5.266$, $p < .000$, $r = .316$), 2 and 6 ($U = 2875$, $Z = 4.780$, $p < .000$, $r = .316$), 3 and 4 ($U = 70767.5$, $Z = 4.427$, $p < 0.000$, $r = .153$), 3 and 5 ($U = 26683.5$, $Z = 3.218$, $p = .001$, $r = .131$) and 3 and 6 ($U = 9914$, $Z = 3.350$, $p = .001$, $r = .146$).

In general, differences between the lower strata (1, 2 and 3) and the others (4, 5 and 6) are observed. These differences indicate more elaborate beliefs in the higher strata (except in the case of the IA scale).

Differences in EB according to area of study

Statistical hypothesis: the null hypothesis is that the central tendency of EB scores is the same in the 6 study areas: 1. Engineering, 2. Psychology, 3. Philosophy, 4. Philology, 5. Economics 6. Secondary [$H_0: E(1) = E(2) = E(3) = E(4) = E(5) = E(6)$], the alternative hypothesis is that the central tendency of the scores is different between any of the study areas [$H_1: E(1) \neq E(2) \neq E(3) \neq E(4) \neq E(5) \neq E(6)$]. The Kruskal-Wallis test indicated statistically significant differences by study area, both in total test scores ($H = 26.471$, $df = 5$, $p < .000$), as in the SK scales ($H = 22.295$, $df = 5$, $p < .000$), QL ($H = 13.925$, $df = 5$, $p = .016$) and CK scales ($H = 126.458$, $df = 5$, $p < .000$). In the IA scale no significant differences were found ($H = 5.457$, $df = 5$, $p = .363$). The post-hoc analysis indicates that these differences occur, in the total score, between engineering and high school students ($U = 91533.5$, $Z = 4.631$, $p < .000$, $r = .150$). In the QL scale differences occur between the groups of engineering-psychology ($U = 49272$, $Z = 2.727$, $p = .007$, $r = .098$) and engineering-secondary ($U = 117004.5$, $Z = 2.906$, $p = .004$, $r = .091$). In the SK scale differences occur between the groups of Economics-secondary ($U = 117004.5$, $Z = 2.906$, $p = .004$, $r = .091$) and in the SC scale, differences occur between the groups of Engineering-secondary ($U = 8599$, $Z = -10.21$, $p < .000$, $r = .316$), Psychology-secondary ($U = 33096.5$, $Z = 7.290$, $p < .000$, $r = .277$), Philosophy-secondary ($U = 391.5$, $Z = 3.488$, $p < .000$, $r = .158$), Philology-secondary ($U = 2685.5$, $Z = 3.349$, $p = .001$, $r = .150$) and Economics-secondary ($U = 7327$, $Z = 2.953$, $p = .003$, $r = .129$). The differences indicate that high school students have less developed beliefs.

DISCUSSION

This paper presents a study of the variables associated with EB in a sample of Colombian students in order to deepen the understanding of factors that influence the

development of EB to generate programs which foster educational intervention on the use of better learning strategies. Particularly, differences in EB development were analyzed between groups of students formed by sociodemographic and educational characteristics. With respect to the hypothesis made at the beginning of the study, results indicate a failure to comply with the first hypothesis, since male students have a greater sophistication in CK. This is opposed to the results of Bendixen, Schraw and Dunkle (1998) and Hofer (2000). Furthermore, there are no significant differences according to sex in other subscales, supporting the mixed pattern results reported by Walter (2008).

As for the type of school (public-private), it was not possible to maintain the initial hypothesis. Following the ideas of Ismail et al. (2013), it was expected that students from public institutions had more developed EB. However, the results of the present study were the opposite: the students of private institutions had greater development of EB. This result may be due to cultural particularities, because private schools in Colombia have more economic resources. In addition, students of private schools usually have higher scores in the test of general diagnosis of the educational system, made in this country every year by the Instituto Colombiano para la Evaluación de la Educación (ICFES) (Núñez, Steiner, Cadena & Pardo, 2002). These results evidence that the socio-economic possibilities and a better performance in the ICFES test could be factors associated with EB development. This is consistent with previous studies which found that students with higher scores in general education assessment tests exhibit greater sophistication in their EB (Hofer, 2000; Paulsen and Wells, 1998).

The hypothesis that students who have repeated a school grade would have less elaborate beliefs has not been confirmed. This may be due to the fact that repeaters represent only 20% of participants. Moreover, it is important to take into account that a period of time would have elapsed from the moment they repeated the course; therefore, it is advisable to measure this variable only in students suspended recently.

Regarding environmental background, no significant differences were found in EB. This is consistent with the literature review and more specifically with the study of Topçu and Yilmaz (2009) where there were no differences between students according to the rural or urban character of the school they attended. Although the data support the hypothesis, it is important to take into account that only 9% of the sample came from a rural environment.

Results allow to maintain the hypothesis that there were differences between students by level of education because university students have more developed beliefs than high-school students, a trend that has been found

previously in other studies (Baldwin and Alsumait, 2013; Walker, 2007).

Concerning the influence of parents' educational level on EB development, results are consistent with the hypothesis that students whose parents have a primary and secondary school level have less elaborate beliefs in opposition to students whose parents have a higher academic level (university and postgraduate). This confirms the importance of the family role on epistemological change (Shommer, 1990).

Following Conley et al. (2004) and Özkal et al. (2011) it was assumed that there would be less sophistication in the EB of students from low socioeconomic status. Data from the present study support this idea, although with some clarifications. Students of stratum 1 have simpler CK and SK beliefs. In contrast, students of stratum 6 have less sophisticated beliefs in the IA scale, which indicates that students of a high stratum, as they have more economic resources, tend to value less the effort and to see learning as genetically determined. This is the same trend that Chen and Pajares (2010) found in their studies.

On the other hand, it is important to mention some limitations of this study. Although there are some significant differences in EB according to the analyzed variables, only a moderate size effect was found. This implies that the estimated magnitude of the differences is weak. The present study represents a challenge for research in EB, since none of the previous studies consulted report the size effect in the estimated differences. Therefore, the question is whether the differences found in previous studies are also weak, as the present research shows.

Another limitation of this study is that the sample, although large, was not selected probabilistically, which limits the generalization of the results. Therefore, some future studies can focus on designing research with probabilistic samples and longitudinal character, to observe the course of EB development and epistemological change. Likewise, it is also suggested to study other populations, such as graduate students or teachers. It is advisable to include in the sample more students who repeated a school grade more recently and also students from public universities. Additionally, it would be interesting to develop more studies about the factors that affect EB in different countries and cultures.

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